Hitotsubashi Journal of Economics 36 (1995) 1-16. © The Hitotsubashi Academy

A DESIGN OF ENVIRONMENTAL TAXES IN JAPAN

HIROMITSU ISHI*

Abstract

This paper has two objectives, based on the assumption that an environmental tax should in future be introduced in the Japanese tax system. One is to clarify general background of environmental issues in relation to the adoption of such a tax. The other is to design a desirable form of environmental tax. Based upon these considerations, the introduction of a new carbon/energy tax is recommended in Japan to solve global environmental problems in the future.

World-wide attention may, in the near future, be paid to whether or not environmental taxes should be practically introduced into the Japanese tax system. This argument is, however, still immature, considering the recent sluggish growth of the Japanese economy. Nevertheless, as the economy enters the phase of recovery in the future, the pros and cons of environmental taxes, like the value-added tax (i. e., the "consumption tax" in Japan) will no doubt become one of the most controversial policy issues towards the 21 century. Today, Japan is expected to take initiatives to solve global pollution problems via bilateral or multilateral negotiations in the international community through its financial resources.

The main aims of this article are twofold. One is to clarify the background of environmental issues and protection in the past. The other is to explore possible ways of designing a desirable form of environmental taxes from the standpoint of economic and environmental policies.

I. *General Background*

During the earlier period of postwar reconstruction in the 1950s and 1960s, great efforts were made to achieve rapid economic growth through business investment. Unfortunately, this growth-oriented policy performance was adopted by both private and public sectors without proper attention to the environment. As a consequence, it led not only heavy pollution and

* My discussion in this paper owe much to policy debate with the members of *study group on environmental taxes* at the Environmental Agency. Particular thanks are given to Mr. Kazuhiro Ohkuma at the Environmental Agency for his computational calculations and data collection. Also, I am indebted to Mr. K. Amoabeng for his editorial assistance in English. This paper was submitted to the 50th Congress of International Institute of Public Finance (IIPF), held in Cambridge, MA, August 22-25, 1994.

irreversible damege to the natural environment, but also resulted in serious health problems, such as Minamata or Itai-Itai diseases, Yokkaichi asthma, etc.

Public concern prompted the adoption of pollution protection policies to avoid great damages to the natural environment as much as possible. In concrete terms, the Basic Law for Environmental Pollution Control was enacted in 1967, and furthermore the Enviromnental Agency was established in 1971 as a primary organization in charge of the environment, under the Prime Minister's office of the government. Both contributed a lot to providing the main basis and impetus for major achievements in relation to pollution control efforts in environmental conservation.

Structural changes in the Japanese economy, caused by two oil shocks in the 1970s, greatly affected the process of environmental conservation and control. As a result of increased price of crude oil, energy-saving behaviors were adopted in industrial activities with great emphasis on the environment, reducing the pollution burden to a great extent. Heavy polluting industries were socially criticized and obliged to the equipped with anti-pollution measures.

Oil crises evidenced that the Japanese economy was founded upon a very vulnerable base of import dependency for basic raw materials. Thus, with the constraint of energy and raw materials, the rate of real economic growth essentially decreased from 10 percent to 5 percent. In turn, a slowdown of Japan's growth coupled with the promotion of pollution control measures and increased energy efficiency in the 1980s led to a reduction in the environmental problems.

On this point, OECD has recently commended enveronmental policies in Japan as follows:

> "Over the past two decades Japan has had the largest economic growth of G7 countries, while substantially reducing emissions of a number of pollutants in the atmosphere and toxic substances in water, and further containing the growth of other pollutants and of waste production. For instance, while economic growth increased over the period by 122 per cent, SO_x emissions decreased by 82 per cent and NO_x emissions by 21 per cent, the best performance among OECD countries. This *decoupling* was achieved through economic structural changes, increased energy efficiency and effective environmental policies. These successes have proved that environmental policies and economic development can be mutually supportive; the competitiveness of Japanese industry has not suffered overall and has even benefited in some sectors (e. g. the automobile industry and the pollution control equipment sector)." (OECD, 1994, p. 182).

As noted above, pollution control policies in Japan have been quite efficient with a number of success stories. As far as pollution control is concerned, Japan's performance has recently been highly evaluated by other industrialized countries. However, these remarkable results of pollution control are limited to specific regions and sectors. In fact, great efforts have been made to abate the damages of air, water or waste pollution in the natural resources.

Apart from the regional scope of environmental problems, the past decade has seen new forms of pollution and environmental deterioration. Long-standing pollution problems in the specific regions are still acute, but at the same time global environmental issues now emerge from acid rain, global-warming, ozone layer depletion, etc. As environmental problems are rapidly widening its scope into a global scale, the existing pollution control measures cannot cover the entire spectrum of environmental policies.

Particular attention is now paid to the environmental damages of global warming, caused by emissions of green gases mainly due to carbon dioxide (CO_2) emissions. It is generally predicted that, given the projected level of CO_2 emissions, average temperature might rise by around 4 degrees over the next 100 years. This trend is expected to continue. Although these estimates are no doubt uncertain, one of the most important objectives of environmental policies is obviously placed on the reduction of CO_2 emissions to some target level. As a matter of fact, an international agreement that CO_2 emissions should be freezed at the 1990 level by the year 2000 is being made by *Framework Convention on Climate Change* which has been advocated by the European Union.

As regards the reduction of CO_2 emission in the world, Japan is also primarily responsible for achieving this target by using some policy instruments. Table 1 shows that the relative share of Japan to total emissions of CO_2 in the world was 4.8 percent in 1991. Japan was therefore ranked as the top fourth nation, following the U.S., the USSR and China. Today, it is widely acknowledged that Japan should play a leading role in reducing CO_2 emissions, not only for itself, but for all other countries in order to solve the problem of global warming.

Since the Rio Environment-Summit was held by the United Nations in June, 1992, the necessity to develop a new framework of the basic law for environmental policies as a whole has widely been recognized among the general public in Japan. Although the passage at the Diet was delayed by the dissolution of the Lower House, *the Basic Environment Law* finally became effective on November 19, 1993.

The contents of the Law are far from clear-cut, and it contains vague interpertation in

TABLE 1. CO_2 EMISSIONS BY MAJOR COUNTRIES IN 1991

	CO_2 emission (million M/T)	Percent distribution (%)
USA	4,932	21.7
USSR	3,581	15.8
China	2,543	11.2
Japan	1,091	4.8
Germany	970	4.3
UK	577	2.5
Canada	410	1.8
Others	8,569	37.9
Total	22,673	100.0

Source: *World Resources 1994-95*, Table 23.1.

Note: Data are CO_2 emissions from industrial processes in terms of million metric tons.

many parts, reflecting policy struggles among several related ministries and agencies. In particular, there have been repeatedly controversial arguments as to the use fo *economic instruments* which implies the introduction of a new environmental tax (say, a carbon tax). The Ministry of International Trade and Industry (MITI) has strongly resisted the adoption of economic instruments via market mechanism in environmental policy, mainly reflecting the MITI's concern over its negative impact on the development of international trade and economic growth. Thus, the Environmental Agency in charge of enacting the Law was obliged to recede from this initial position to a great extent.

In Article 22 of the Basic Environment Law, the term "*economic measures*" not "*instruments*", is referred to as a policy "to prevent interference with environmental conservation." Main points are stated as follows.

> "The government shall appropriately conduct surveys and researches on the effectiveness of implementing such measures with regard to prevention of interference with environmental conservation and on the effects of such measures on the Japanese economy; and should it be deemed necessary to implement such measures, the government shall make efforts to seek the understanding and cooperation of the people with regard to utilization of such measures to prevent interference with environmental conservation. In this case, should such measures be implemented for global environmental conservation, the government shall consider international collaboration so as to appropriately ensure the effectiveness of such measures."[1]

In spite of the critical views noted above, the Law plays a very important role in defining the basic nature of environment as a public good rather than a free good. It is generally believed that it has provided the fundamental base for discussions on the introduction of economic instruments in light of taxes and charges.

II. *Towards the Use of Economic Instruments*

The environmental tax, regardless of the way in which it is formulated, is one of the typical economic instruments. Therefore, discussion in favor of environmental taxes have been developed, closely tied with the recent trend of supporting the adoption of market forces and economic instruments.

Anticipating the future expansion of global environment issues, an important consequence is that economic and environmental policies cannot be separated. The need for an effective integration between the two is needed to solve environmental problems on a global scale from the standpoint of greater economic efficiency. No doubt, it is important to evolve a wider use of market mechanism through economic instruments in order to improve this efficiency.[2] Since the early 1980s, the move towards the use of economic instruments in environmental policy has increased sharply, in particular among OECD countries. Japan follows this trend with substantial time lag, and is now trying to catch up with the advanced

[1] See, An English excerpt of The Basic Environment Law (Environmental Agency, 1993). The original text in Japanese is much more difficult to understand.

[2] This is strongly promoted by OECD. See, for instance, OECD (1991a), OECD (1991b).

level of adopting economic instruments performing in some OECD countries, say the Nordic countries.

According to the general classification of economic instruments, there are four types: (1) taxes and charges, (2) subsidies, (3) tradable permits, (4) deposit-refund systems.[3] Our primary concerns are with taxes and charges among these four types for several reasons mentioned below.

Economic instruments should be contrasted with direct regulation within the broader scope of environmental policies. Traditionally, in carrying out environmental policies top priority has so far been placed on direct regulation of environmental damage and pollution in Japan. The MITI still attaches greater importance to this policy and is therefore likely to continue. The "command-and-control" type of regulation has often generated prompt and remarkable results of pollution abatement, coupled with strict enforcement of emission-restraint standards by government intervention. A number of successes in overcoming the issues of industrial pollution were induced by direct regulation.[4] Thus, the first priority tended to be put upon regulation-type of environmental policy in Japan.

As the second environmental policy, subsidy policies have frequently been employed in the form of "tax expenditures" (i. e., disguised subsidies), rather than direct subsidies from the expenditure side of budget. There are not direct subsidies for environmental protection given to private enterprises with a few exceptions (e. g., R & D in a specific area) in Japan. Typical cases of tax expenditures are tax exemption, special or accelerated depreciation, tax credits and special deduction to encourage the development or use of certain techniques or technologies for pollution abatement and energy saving.[5] "Environmental policy" in Japan simply means such indirect subsidies as tax concessions, which are listed in special tax measures of national and local tax systems.[6]

These two instruments that we have traditionally employed could not be justified exclusively at present, given the current state of environmental problems. First of all, the emergence of global warming makes direct regulation through government intervention ineffective or almost impossible. The effect of regulation is regionally restricted to a narrow district, not enlarged to a global region. Second, there is one important practical consideration that counts against the use of environmental subsidies. These subsidies tend to provide a form of protection for the industries concerned, and it may be relatively easy for protectionist pressures to increase subsidies for the reason of environment conservation. Obviously, such indirect or concealed protection in the guise of environmental policy is against the Polluter

[3] See, for example, OECD (1989), OECD (1993). In addition to these four types, sometimes other categories such as market creation, financial assistance or enforcement incentives are employed in OECD documents. As regards the Japanese environment policy, see, Kazu Kato (1993).

[4] One example is shown in the case of NOx reduction for passengers' car. By strong regulation of emission gas control at the manufacturing level, emissions of NOx have drastically decreased by a big margin of 92 percent for five years from the enforcement of this regulation in 1972 (Source: data presented to Central Environmental Commission by the Ministry of Transport).

[5] Typical examples are (1) special initial depreciation for solar and energy saving equipment, pollution preventing equipment and recycling equipment, and (2) tax reduction for air, water and noise abatement equipment, asbestos emission reduction facilities, oil desulphurization facilities.

[6] Special tax measures in relation to environment-abatement are widely applied not only to personal and corporate income taxes, the inheritance tax, the stamp duties and register-license tax in the national taxes, but also to the fixed asset tax, special land-holding tax and business-site tax in the local taxes.

Pays Principles (PPP) adopted by OECD countries.[7]

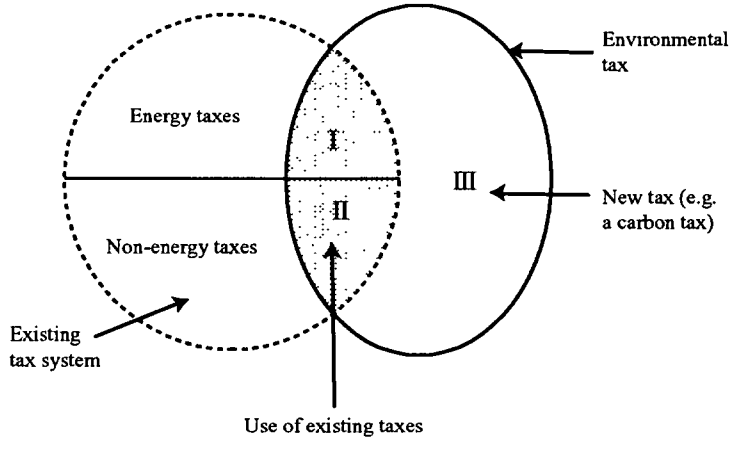
In order to rectify these drawbacks of traditional types of environmental policy, greater stress is now placed upon the role of tax instruments. Within the broad category of economic instruments, tax instruments are only one of many options. However, in view of environmental market mechanism which use price incentives to encourage individual decisions benefiting the environment, taxes are regarded as one of the most efficient instruments in environment policy. This is likely to be supported by many when environmental problems are widely extended to a global scale, as stressed repeatedly.

Within this new phase of global environmental issues, environmental taxes need to be explored and incorporated into tax structures in the context of integrating economic and environmental policies. It is important, however, to note that tax instruments and other types of environment policies (i. e., regulation and subsidies) should reinforce and support each other. This implies that the present situation is characterized by the prevalence of a "mixed system", in which environmental taxes complement regulation according to the type of environmental pollution.

III. *Restructuring the Existing Tax System*

When we consider the possibility of designing the environmental tax in the Japanese tax system, there are a number of distinct types. In order to clarify alternative types of the

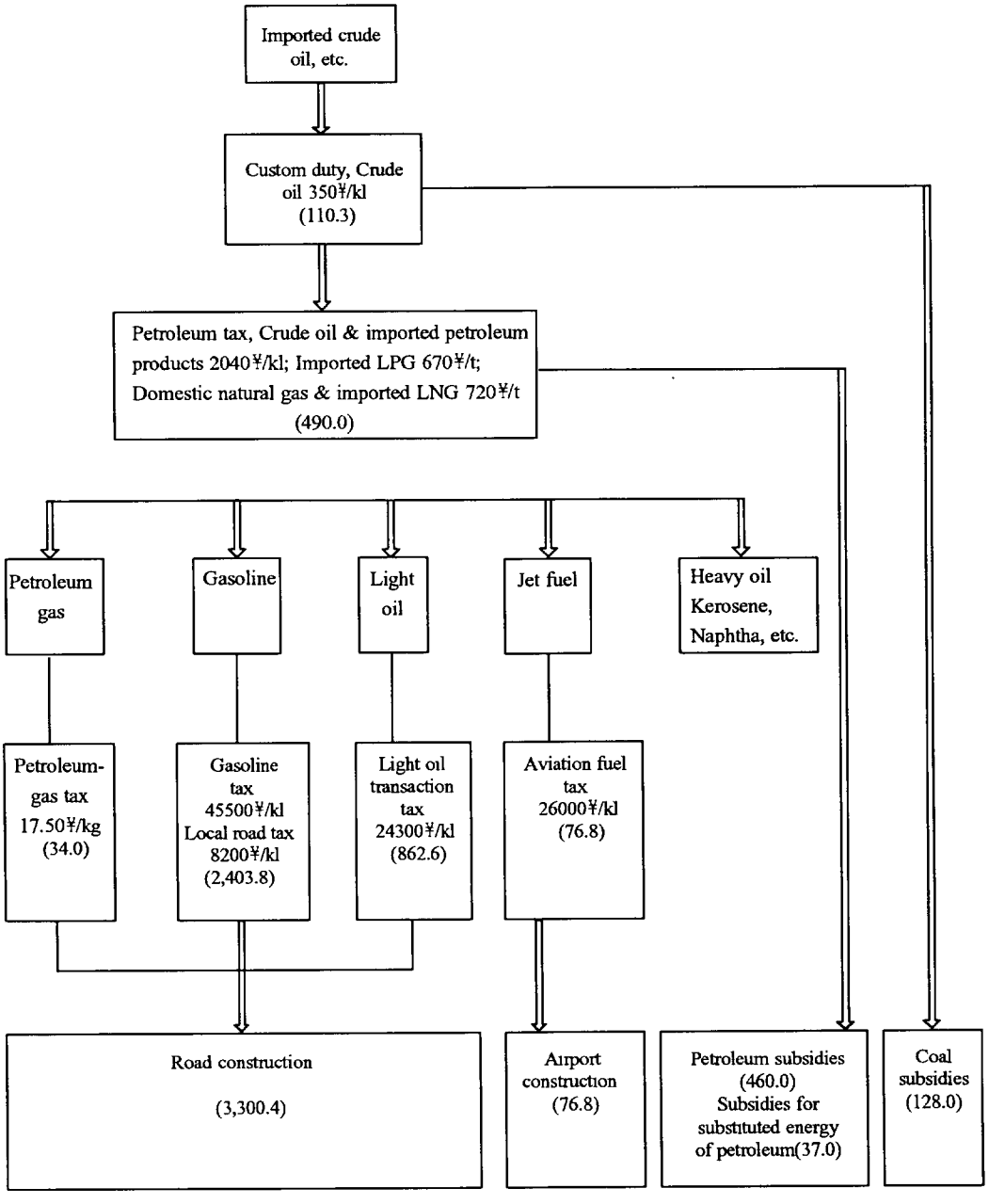
FIGURE 1. ALTERNATIVES OF THE ENVIRONMENTAL TAX



[7] The PPP is explained as follows:

"The principle to be used for allocating costs of pollution prevention and control measures to encourage rational use of scarce environmental resources and to avoid distortions in international trade and investment is the so-called "Polluter-Pays Principle." This principle means that the polluter should bear the expenses of carrying out the above-mentioned measures decided by public authorities to ensure that the environment is in an acceptable state. In other words, the cost of these measures should be reflected in the cost of goods and services which cause pollution in production and/or consumption. Such measures should not be accompanied by subsidies that would create significant distortions in international trade and investment (see, OECD (1972)).

FIGURE 2. TAX RATES, REVENUES AND EARMARKING OF ENERGY TAXES IN FISCAL 1992



Source: Ministry of Finance, *An Outline of Japanese Taxes*, 1993.
Note: Figures in parentheses are revenues of each tax and earmarked expenditures in billion yen.

environmental tax, two circles have been drawn in Figure 1: one shows the position of the existing tax system (dotted line), and the other that of new forms of the environmental tax (bold line). Dependeing upon the demarcation of energy and non-energy taxes in the existing tax system, three zones are derived from Figure 1. Zone I and II constitute the use of existing taxes, while zone III implies the creation of a new environmental tax, such as a carbon tax.

Let us first focus upon energy taxes in zone I. Energy taxes are only one environment-related tax in the existing tax system, but their revenues are mainly earmarked for road construction and others without reference to environmental policies in Japan. Energy resources in Japan are almost all derived from petroleum and its derivatives which are totally

TABLE 2. TAX BURDEN PER TON OF CO_2 EMISSIONS

By energy	Category of energy taxes	Tax rates (1)	A thermal unit of energy (2)	CO_2 emission per a thermal unit of energy (g/1000 kcal) (3)	Taxes per CO_2 emissions (¥/t) (4)
Crude oil		2390¥/kl	9400 kcal/l	80.23	3169
	Custom duty	350¥/kl	9400 kcal/l		
	Petroleum tax	2040¥/kl	9400 kcal/l		
Heavy oil	Petroleum tax	0¥/kl	8000 kcal/l	80.46	0
Light oil	Light oil transaction tax	24300¥/kl	9200 kcal/l	78.39	33694
Kerosene	Petroleum tax	0¥/kl	8000 kcal/l	77.47	0
Jet fuel	Aviation fuel tax	26000¥/kl	8700 kcal/l	76.65	38989
Gasoline	Gasoline tax Local road tax	53800¥/kl	8400 kcal/l	76.58	83635
Naphtha	Petroleum tax	0¥/kl	8000 kcal/l	76.05	0
LPG	Petroleum-gas tax	18170¥/t	12000 kcal/kg	68.33	22160
Natural gas	Petroleum tax	720¥/t	9800 kcal/kg	56.39	1303
Imported LNG	Petroleum tax	720¥/t	13000 kcal/kg	56.39	982
Coal		0¥/t	6350 kcal/kg	99.60	0

Source: Environmental Agency

Note: $(4) = \dfrac{(1)}{(2) \times (3)}$

dependent on overseas markets. Various types of taxes are imposed on different forms of energy under different considerations, including not only economic but political reasons.

In Figure 2, current structures of energy taxes are summarized in terms of tax rates, revenues and earmarking in fiscal 1992. Taxes are levied at the three stages from imports to petroleum derivatives for end-users. At the first stage of imports, the customs duty is imposed on crude oil. Then, the petroleum tax is levied on crude oil, and furthermore on imported LPG and LNG, and domestic natural gas. Finally, other related taxes are imposed on petroleum gas, gasoline, light oil and jet fuel, but heavy oil, kerosene and naphtha are completely nontaxable except the tax burden at the earlier stages (i. e., custom duty and petroleum tax). Tax rates applied to each tax base are all specific rates. Although not indicated in Figure 2, any form of coal, imported or domestic, is not subject to taxation.

Tax revenues collected at each stage are earmarked for four public expenditures: (1) road construction, (2) airport construction, (3) petroleum subsidies, and (4) coal subsidies. The largest revenues among all energy taxes are produced by the gasoline tax. Consequently, gasoline is most heavily burdened in total petroleum-related products in Japan.

As argued previously, present energy taxes have no bearing upon environmental policies, but are exclusively collected mainly for the purpose of securing financial sources of road construction. This is evident from Table 2 where tax burden per ton of CO_2 emissions is calculated. Different sorts of fossil fuels contain different carbon contents, and discharges different emissions of CO_2 into the air. Crude oil and derivatives, which mainly constitute peresent energy taxes, are one of the important fossil fuels, and are thought to generate a great deal of carbon and in turn CO_2.[8] If we should consider energy taxes as a tax instrument in environmental policy, tax structures must be designed carefully in view of greater efficiency to reduce both CO_2 emittions and potential global warming.

As evident from Table 2, however, tax burden of each type of energy is not fully related to the level of CO_2 emissions. The largest burden is imposed on gasoline, followed by jet fuel and light oil, in spite of relatively smaller CO_2 emissions per a thermal unit of energy. By contrast, coal, heavy oil and naphtha are fully exempted from energy taxes while they generate larger amounts of CO_2 emisions. These results reflect the fact that energy taxes cannot play any significant role in achieveing environmental protection on a global scale. Thus, if we try to convert the present energy taxes into a new form of environmental taxes, it would be neccessary to restructure the existing tax system to a considerable extent.

Next, let us move to the use of existing tax system concerning non-energy taxed (zone II in Figure 1). At present, there is no generalized system of non-energy taxes to be regarded as the environment tax in Japan.

According to recent survey of existing tax instruments among OECD member countries, there are a number of cases in using existing taxes, which have generally been introduced for non-environmental reasons in the past but now become increasingly important from environmental considerations (see, OECD 1993). For example, special attention should be paid to taxation of road transport and motor fuels. Existing taxes on road transport include vehicle-related taxes, such as (1) sales taxes on new motor vehicles with higher tax rates, (2)

[8] According to the estimates by the Environmental Agency concerning CO_2 emissions by fuels, petroleum occupies the largest share 57.1 percent of total, followed by coal 24.4 percent and natural gas 9.1 percent in fiscal 1989.

special taxes on the registration or use of motor vehicles, and (3) tax deductibility for less environmentally-damaged cars.

Similarly, motor fuels are generally subject to a number of different non-energy taxes: e.g., (1) higher rates of VAT or general sales tax on petroleum and automotive diesel, (2) excise taxes on motor fuels and (3) environmental damage taxes (say, CO_2 tax), and fuel storage taxes.

Another attention is paid to taxes on goods and services in the area of non-energy taxes for environmental protection. Typical examples include (1) taxes on agricultural fertilizers and pesticides, and (2) product taxes on batteries, plastic carrier bag and disposable drinks containers.

Many countries in OECD have already begun to use these types of environment-related taxes widely at the practical level. Generally speaking, however, there is no idea yet to convert or remodel these existing taxes into a new environmental tax in Japan.

Apart from these typical types of environmental taxes listed above, we can point out a couple of pollution charges about the use of the existing system in Japan. Pollution charges, which are used to provide direct control over environmentally-sensitive activities, usually impose sources of pollutant emissions (or effluents), or the users of pollution control equipments. Specific charges are levied upon air or water pollution, waste and aircraft noise mostly by local governments.

In particular, it is noted that air pollution charge is connected with air pollution-related health damage compensation system. Based upon the PPP, the compensation system is devised to settle the conflicts between the polluter and the victims on the basis of civil liability. This arrangement is separate from the social security system (see, for detailed discussion, Kazu Kato, 1993). Air pollution charge is calculated in terms of sulfur oxides (SO_x), and is collected from industrial sites and business firms who release any amount of SO_x into the air. Pollution victims are compensated by a fund whose revenue is raised by this charge (80 percent) and the automobile tonnage tax (20 percent).

To sum up, the current tax structure is not effective from the standpoint of minimizing environmental problems in Japan. There is, however, considerable scope for environmental targets to be reflected through the restructuring of existing taxes rather than the introduction of wholly new taxes.[9]

IV. *Designing a new form of environmental taxes*

Next, we shall shift our attention to new forms of environmental taxes (zone III in Figure 1), apart from the use of existing tax system. There are two reasons to promote the introduction of such a new tax in Japan.

For one thing, it is politically almost impossible to convert existing energy taxes, most of which are earmarked for financing road construction, into an environmental tax. There would be no support among politicians and bureaucrats to use even a part of, say, the gasoline tax for the purpose of environmental protection, reflecting strong pressure of vested interest groups.

[9] Tradable permits and deposit-refund system, which are often referred to as other type of economic instruments, have not yet been put into operation in Japan.

TABLE 3. HYPOTHETICAL TYPES OF CARBON TAX AND CARBON/ENERGY TAX IN 1992

Type 1: At the Stage of Importation					Type 2: At the Consumption Stage				
Energy Sources	Carbon tax		Carbon/energy tax		Energy Sources	Carbon tax		Carbon/energy tax	
	¥b	%	¥b	%		¥b	%	¥b	%
Coal Material	567.0	15.9	507.2	14.3	*Coal* Material	69.9	2.0	62.6	1.6
General	370.4	10.1	325.0	9.2	General	365.5	10.2	320.4	8.4
Hard	19.8	0.6	17.4	0.5	Hard	11.5	0.3	10.0	0.3
Crude oil	1872.3	52.4	1872.5	52.9	*Coke*	245.0	6.8	200.3	5.2
NGL	54.6	1.5	55.3	1.6	*Coke furnace gas*	39.0	1.1	53.6	1.4
Petroleum					*Blast &*	321.0	9.0	209.9	5.5
Gasoline	5.7	0.2	5.7	0.2	*revolving furnace gas*				
Naphtha	142.2	4.0	144.1	4.1	*Crude oil*	174.0	4.9	174.0	4.6
Kerosene	16.6	0.5	16.6	0.5					
Light oil	3.7	0.1	3.7	0.1	*NGL*	2.5	0.1	2.6	0.1
A heavy oil	0.2	0.0	0.2	0.0					
B heavy oil	0.1	0.0	0.1	0.0	*Petroleum*				
Oil coke	45.0	1.3	39.0	1.1	Gasoline	356.8	10.0	360.4	9.4
LPG	127.6	3.6	136.8	3.9	Naphtha	60.4	1.7	61.2	1.6
					Jet fuel	31.4	0.9	31.7	0.8
Natural gas	14.3	0.4	17.0	0.4	Kerosene	224.6	6.3	225.5	5.9
					Light oil	346.3	9.7	345.7	9.0
LNG	336.5	9.4	401.4	11.2	A heavy oil	238.9	6.7	237.3	6.2
					B heavy oil	1.4	0.0	1.4	0.0
					C heavy oil	460.2	12.8	449.8	11.8
					Oil refinery gas	57.8	1.6	67.0	1.8
					Oil coke	39.9	1.1	34.6	0.9
					LPG	151.6	4.2	162.4	4.3
					Natural gas	10.4	0.3	12.5	0.3
					LNG	251.1	7.0	299.5	7.8
					City gas	123.6	3.4	144.5	3.8
					New energies	0.0	0.0	33.7	0.9
					Hydro power	0.0	0.0	89.1	2.3
					Nuclear power	0.0	0.0	230.5	6.0
Total	3576.0	100.0	3542.0	100.0	Total	3582.8	100.0	3820.2	100.0

Source: Author's estimates from *Energy Statistics* (Sogo Energy Tokei)(MITI: 1992)

Note: The tax at $10 per barrel of crude oil equivalent are levied to all sources of energy by the carbon component and/or the energy (thermal) component; 10%:0% in the carbon tax, and 50%:50% in the carbon/energy tax.

Thus, an idea of designing a new tax would be more appropriate and feasible. The other reason is that external pressure in the international community will increase to facilitate incorporation of a new tax (e.g., a carbon tax) into the national tax system. Either bilateral or multilateral negotiation may push Japan to execute its responsibility to abate environmental damage by tax instruments in light on international policy coordination.

When we consider any desirable type of environmental taxes, it is important to tax both fossil energy sources in view of its objective of limiting CO_2 (i.e., carbon) emissions and all forms of energy in view of its promoting efficient use of energy. For this purpose, the EC proposed to adopt a tax on carbon emissions and energy; i.e., carbon/energy tax (EC 1992).

Let us explore the possible forms of carbon/energy tax in Japan, based on the EC proposal. The sources of energy concerned are fossil fuels (coal, oil, natural gas and their derivatives) and electricity generated by hydroelectric installations and nuclear power stations. It is assumed that the new tax is imposed on relevant energy sources at two stages of importation and consumption with a tax rate of $10 per barrel of crude oil equivalent.[10] Primary energy sources are taxed at both stages, while electricity and city gas (i.e., a second form of energy) are only levied at the consumption level.

The results of estimates in 1992 are summarized in Table 3, which are divided into the carbon tax and the carbon/energy tax. The tax base is a composite one, with 50 percent being accounted for by the carbon content of the energy source and 50 percent by its energy content in term of thermal unit. The carbon tax is estimated as an extreme case of carbon/energy tax, assuming 100 percent carbon component. There are four points to be noted.

First of all, total revenues of a new tax account for ¥3.6 - 3.8 trillion in any case, which is about 6 percent as a percentage of national taxes in 1992. It is expected to generate substantial amount of tax revenues, ranked at the fourth in total revenues, following the individual income tax, the corporate tax, and the consumption tax.[11]

Second, at the stage of importation, more than half of total revenues are collected from crude oil, and furthermore nearly 80 percent from both crude oil and coal. If the new tax is levied at this stage, tax practices would be administered very efficiently with least cost of tax collection.

Third, by contrast, at the consumption stage, taxes are dispersed in various forms of energy sources, including city gas and electricity. The relatively larger shares are occupied by coal (general), gasoline and C heavy oil.

Fourth, obviously the carbon tax excludes the taxes on electricity by nuclear power. This implies that the carbon tax tends to promote the construction of nuclear power stations, which would be criticized by anti-nuclear groups. To avoid such a criticism, the adoption of carbon/energy tax at the consumption stage might be more recommendable as a new environmental tax than a simple form of carbon tax.

[10] The EC proposes that the tax will be phased in gradually, starting at $3 a barrel of oil equivalent on 1 January 1993 and rising by $1 a barrel a year to $10 a barrel of oil equivalent in the year 2000.

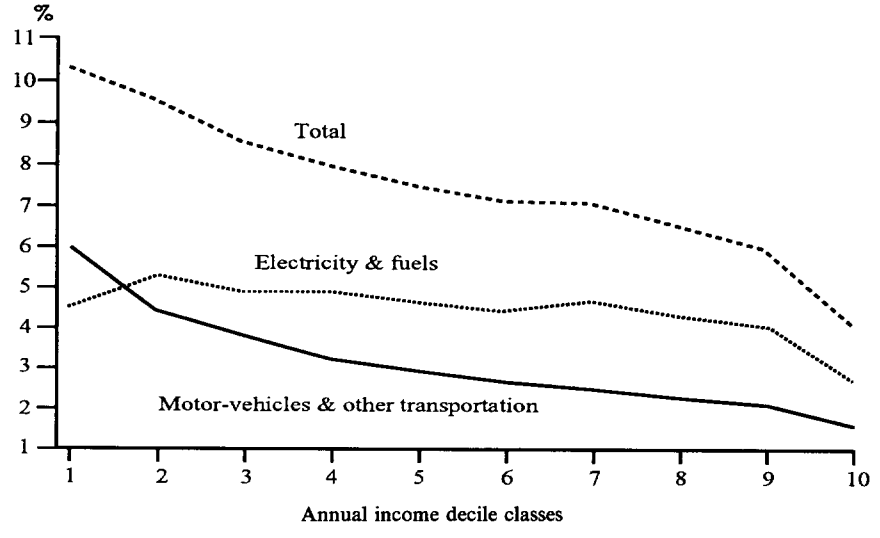
[11] In fiscal 1992, the individual income tax generated ¥26.0 trillion (41.4%), the corporate tax ¥18.4 trillion (29.3%), and the consumption tax ¥4.6 trillion (7.4%). Percentages in parentheses are relative shares of each tax in total national taxes.

V. *Key Issues Raised by Environmental Taxes*

Before concluding the arguments in this paper, it is necessary to consider some aspects of introducing a new environmental tax mentioned above. Although there are a number of key issues to be worth investigating, some reference is made to the following four points concerning the distribution of the environmental tax burden and the extent of negative impact on economic growth.

First, the introduction of carbon/energy tax is likely to have a significant distributional effect, because of the importance of energy expenditures in the budgets of poorer households. Figure 3 illustrates this fact in terms of environment-related expenditures as a percentage of annual income at different levels of incomes. Two expenditures of electricity & fuels, and motor-vehicles & other transportation evidently indicate declining trends of relative shares in household budgets as income levels rise. If the tax base of a new environmental tax at the consumption level is equivalent to these expenditures, a flat rate of tax would generate heavier tax burden on lower income earners. No doubt, the basic characteristics of the environmental tax is regressive. It is thus important to consider whether it might be possible to seek policy package so that distributional issues that might otherwise produce a significant obstacle are offset or at least mitigated.

FIGURE 3. PATTERNS OF HOUSEHOLD ENVIRONMENT-RELATED EXPENDITURES AS A PERCENTAGE OF ANNUAL INCOME IN 1992



Source: Author's calculation from *Annual Report of Family Income and Expenditure,* Office of the Prime Minister, 1993.

Second, and related to the first point, focus is upon the use of the revenues from environmental taxes. This issue is very important and will be getting more controversial in

Japan. Given the regressiveness of carbon/energy tax, tax revenues, partially or wholly, should be first appropriated to reduce the individual income tax, including local inhabitant taxes, and not to increase overall tax pressure on households. A portion of the revenues might also be used to decrease corporate tax burden from an econommic standpoint of mitigating detrimental burden caused by environmental taxes. When such a new tax is introduced as part of a revenue neutral package, the political acceptability will be enhanced to a greater extent.

Third, another alternative use of the revenues should be for financing of environmental expenditures in the public sector. Currently there exist a number of environmental taxes and charge earmarked by specific programs and funds in many countries. Obviously, this earmarking problem will be decisively important in Japan when a new environmental tax is adopted, because relevant ministries and agencies are very keen to secure financial sources from this tax. It is clear that there are always conflicting interests among related bureaucrat groups in the use of the revenues. Generally speaking, earmarking of such a new tax to some environmental objective, including ODA (official development assistance) for environmental protection, will be of great help to increase transparency of the measure and to generate political support. Although earmarking is, in the long run, likely to induce undesirable rigidities in the budgeting process, it should be stressed as a transitory solution to make the introduction of the tax more acceptable.

Lastly, attention should be paid to the macroeconomic effects caused by the introduction of environmental taxes, although it is not the central focus of this paper. In addition to the direct impact of additional tax payments on the distribution of household incomes, environmental taxes are expected to have wider repercussions on the economy: i.e., effects on employment, price, production, industrial structure, international competition and so. Many firms as well as the MITI[12] tend to express their misgivings about the detrimental effects of environmental taxes on the working of the Japanese economy.

Macroeconomic effects have so far been investigated using a variety of econometric models. Indeed, now in Japan, simulation results of approximately ten models analyzing the possible effects of carbon tax on the future trend of the Japanese economy (see, for more detailed discussion, A. Amano 1992) are available. It is very difficult to reach any decisive conclusion about analytical results, but the consensus of research to date seems to be that the macroeconomic effects of carbon tax are likely to be quite limited. For example, a certain study group at the Environmental Agency has recently pointed out[13] that a carbon tax rate might be set around ¥9,000 - ¥35,000 in 1995 per ton of carbon in order to keep CO_2 level of the year 2000 at the same level as that of 1990, assuming there are no other instruments than a carbon tax. The impact of such a new tax on the Japanese economy would perhaps slow down real growth rate by about 0.01% - 0.5% annually. The other estimates show, more or less, similar results of reduced growth rate slightly by the introduction of the carbon tax [see, for instance, M. Kuroda (1993)]. Given these empirical results in quantitative terms, we can safely conclude that the macroeconomic effects of the environmental tax would possibly be smaller

[12] The MITI establishes a couple of task forces or working groups under the *Industrial Structure Council* to study the economic effects of environmental taxes. Broadly speaking, the basic attitude of the MITI is to attain the target of solving global warming by encouraging corporations and households to adopt energy-saving measures without any restriction and tax on CO_2 emissions.

[13] See, the recent interim-report of the study group on the economic system under global warming, April, 1994. Also, see K. Gregory et al, 1991.

than generally expected.

Taking account of the issues noted above, any form of a new environmental tax (say a carbon/energy or carbon tax) should be adopted in the Japanese tax system in conjunction with a future tax reform. As seen in Table 4, the level of implicit carbon tax is still lower than international standards, following the US and Canadian cases. Tax burden on carbon emissions could be raised to a substantial degree, if we consider prevailing rates in the European countries.

TABLE 4. IMPLICIT CARBON TAXES IN 1988
($ per ton of carbon)

	US	Japan	Germany	France	Italy	UK	Canada
Implicit carbon tax							
Oil & oil product	65	130	212	351	317	297	108
Gas	0	2	23	38	80	0	0
Coal	0	0	0	0	0	0	0
Total	28	79	95	229	223	106	52
Implicit subsidy and price support for the coal industry							
Subsidies for coal industry	..	2	28	25	..	10	..
Price support	..	15	49	..	..	36	..

Source: Peter Hoeller and Markku Wallin (1991), p. 23.

In view of tax incidence, the ultimated burden of such a tax should be theoretically shifted to consumers through the price mechanism. Thus, the tax might be desirable to be imposed on the consumption level of energy sources. However, considerations of international competitiveness might be important to mitigate or exempt the burden of environmental tax for industries which are highly energy-intensive (e.g., steel industry).

In conclusion, unlike the use of existing taxes, the introduction of a new environmental tax would be strongly recommended in the following formula:

- Carbon/energy tax, whose contents are evenly divided,
- Taxing point at the consumption level of energy sources,
- The reduction of the existing taxes to offset the undesirable effects and/or the increase of environmental expenditures to reinforce the environmental effects of the tax.

HITOTSUBASHI UNIVERSITY

REFERENCES

Akihiro Amano (1992), *Global Warming and Economic Growth--Modeling Experience in Japan* (National Institute for Environmental Research).

EC (1992), *Commission Adopts Proposal on Carbon/Energy Tax*, May 27, 1992.

K. Gregory, A. Matthews, A. Newton and A. Nind (1991), The Potential Impact of a $10/barrel Energy/Carbon Tax on UK Carbon Dioxide Emissions (OECD, Workshop on Carbon Taxes).

Peter Hoeller and Markku Wallin (1991), *Energy Prices, Taxes and Carbon Dioxide Emissions* (Paris; OECD).

Kazu Kato (1993), "The Use of Market-Based Instruments in Japanese Environmental Policy," (mimeo).

Masahiro Kuroda (1993), "Reducing CO_2 Emissions and Long-run Growth of the Japanese Economy," Paper submitted to Energy Technology System Analysis Program Conference, Oxford, June 2, 1993.

OECD (1972), *Guiding Principles Concerning International Economic Aspects of Environmental Policies* (Recommendation of the Secretary-General, May 26).

OECD (1989), *Economic Instruments for Environmental Protection*.

OECD (1991a), *Environmental Policy: How to Apply Economic Instruments*.

OECD (1991b), *An Environmental Strategy in the 1990s* (Communique of the Environmental Committee at the Ministerial Level, Jan. 1991).

OECD (1993), *Taxation and Environment*.

OECD (1994), *Environmental Performance Reviews; Japan*.